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(54) Reading smart cards

(57) A pouch for a smart card is provided with electrical contacts 13,13' for connection with electrical contacts of an inserted smart card and an antenna loop is, thereby changing in use the capacity of the inserted card to receive and/or transmit external signals. A smart card includes a memory section connected to contact pads on the surface of the card.

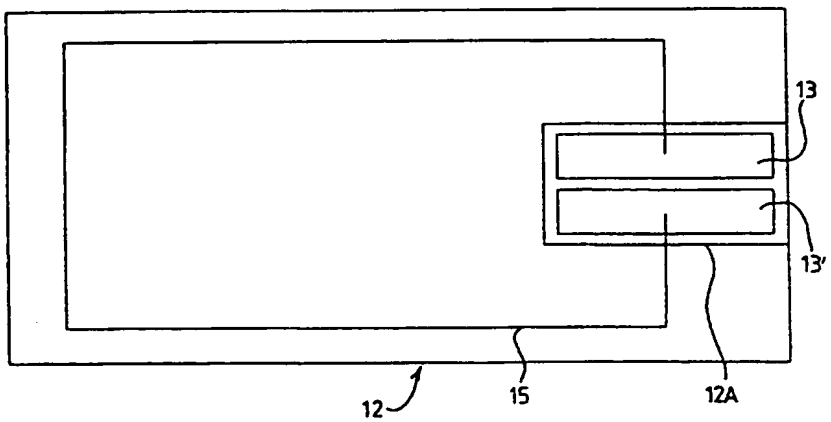

FIG 3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

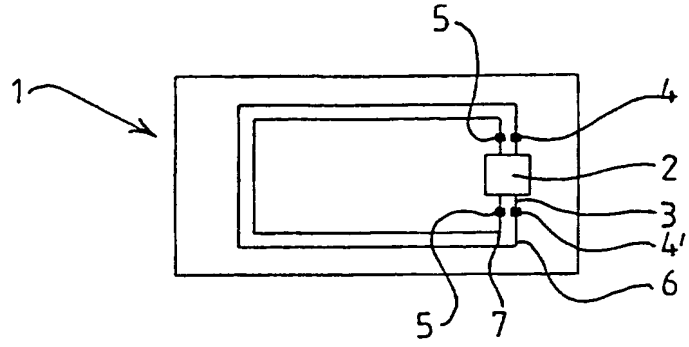

FIG 1

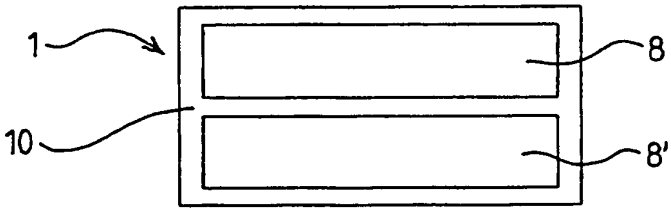

FIG 2

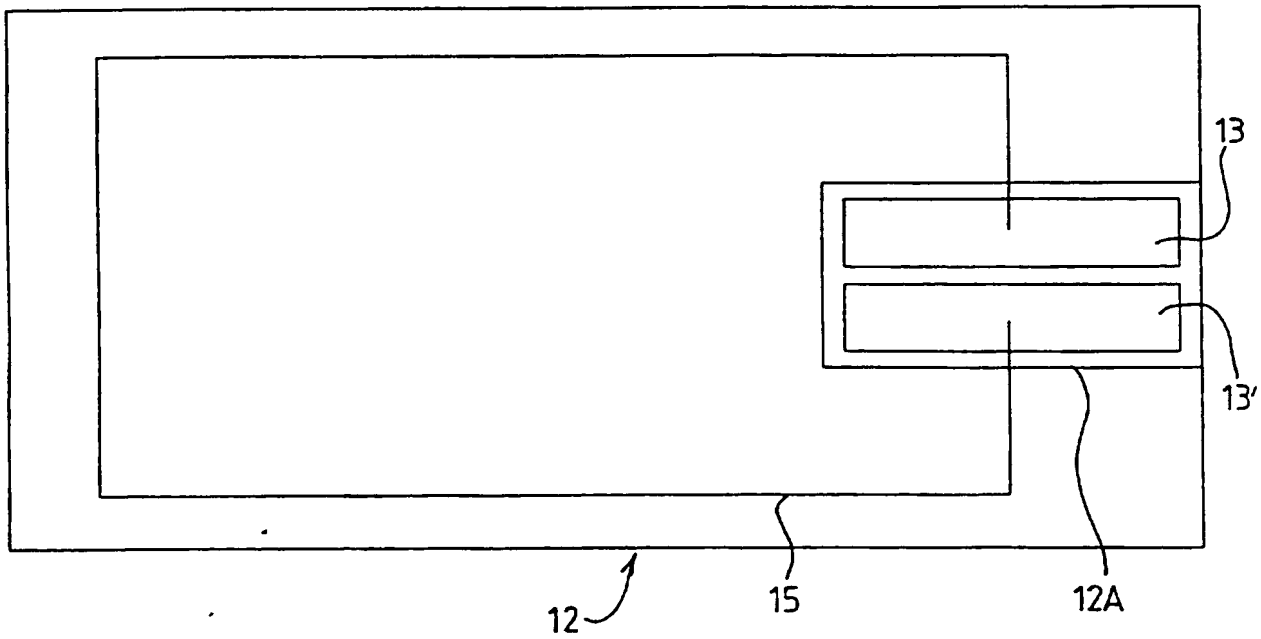

FIG 3

"Improvements in or relating to smart cards"

THIS INVENTION relates to a system for smart cards. The invention relates to a pouch system for smart cards and, in particular, non-contact smart cards, to contact and non-contact smart cards adapted for use with the pouch system, and to the provision of a system employing a plurality of such pouches and such cards.

Smart cards contain a surface mounted or embedded chip on the card. This chip contains a microprocessor and a memory area. The data stored in the memory area is accessible when the card is inserted into an appropriate form of card reader. Some of the memory area is usable during the course of the transaction to record new data received by the card from the card reader. Such a smart card has an array of contact pads, generally of gold, which are positioned in a standard arrangement on the card face. The power supply to the card is provided through the contact pads.

To conduct a card transaction the smart card is inserted into an appropriate card reader, which makes electrical contact with the contact pads. The chip microprocessor is then powered up and, following an appropriate handshake, a transaction is conducted according to parameters entered at the reader side.

It is desirable to use smart card technology in environments where it would not be appropriate or convenient physically to insert a card into a card reader. Such circumstances are, for example, in mass transit systems, in road tolling, in car park ticketing and for automated warehouse control. Accordingly, non-contact

smart cards have been developed. Such cards are similar to the cards described above (referred to below as contact cards), but instead of transmitting and receiving data through metal contact pads on the card surface, data is received and transmitted by means of an antenna loop and an induction coil to emit and receive electromagnetic waves at an appropriate frequency.

Such cards can be powered in different ways. In one form of card, a small battery can be mounted on the card to power the chip which can be kept in a "sleep mode" at times when no transaction is to be conducted and brought to full operation when a signal from an appropriate signal source is detected. In another form of card, there is no power source on the card itself and power is provided from outside by inducing a current in an induction coil mounted in the card. When the card is brought into proximity with a larger external coil with significant current flowing through it, current is induced in the induction coil in the card by means of inductive coupling. This current powers the chip on the card which then boots up, handshakes and conducts the desired transaction. An advantage of this system is that unauthorised access to the card is relatively difficult as, in addition to the necessary signals for communication with the card, the card must also be sufficiently close to an appropriate external coil for it to be powered up. In known systems, this distance is typically in the region of 10 cm.

A difficulty with the existing non-contact cards is that their range of operation is relatively small as it is not practical to place a large coil and antenna arrangement in or on a smart card having an ISO-defined standard size. The antennae used are essentially of normal wire but with a high carbon content and are often shaped (particularly by

use of wire of a D-shaped cross-section) to enhance their effectiveness and to give them directional properties.

Even after optimisation of the antennae, a reading range of 15 cm or so is typical. There also still exists the problem of unauthorised access to the card. Although it is difficult to achieve such access because of the close proximity to a card reader required to effect communication, it is nonetheless not impossible. It is moreover possible that use of more powerful transmitters could enable access to the card at greater distances.

Accordingly, the present invention provides a pouch system for smart cards, wherein said pouch system is provided with electrical contacts for connection with electrical contacts of an inserted smart card, thereby changing in use the capacity of the inserted card to receive and/or transmit external signals.

Further, this invention provides a smart card for use with a pouch system, which smart card comprises semi-conductor circuitry including a memory section and further comprises an induction coil and an antenna, said semi-conductor circuitry by conducting tracks, said semi-conductor circuitry being connected to contact pads formed on the surface of the card.

So that the invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a smart card embodying the present invention shown with the top laminate layers

removed to expose a chip, antenna and induction coil mounted on an intermediate layer in the card;

Figure 2 is a plan view of a top surface of the card of Figure 1; and

Figure 3 is a schematic view of one half of a pouch embodying the present invention for receiving the card of Figures 1 and 2, the plan view of the other half corresponding.

Conventional smart cards comprise a number of laminated layers. A chip is typically located on the card after some, but not all, of the lamination layers have been formed. Smart cards embodying the present invention, such as that shown in Figures 1 and 2, need not have the chip embedded at an intermediate stage of the lamination process. It is possible to form a card by lamination and then to mount the chip on top of the card. A typical card is in the region of 30 thousandths of an inch thick (0.76mm).

Figure 1 shows a card 1 embodying the present invention from which the top lamination layers have been removed to expose a chip 2. Tracks 3 on the card 1 are laid down to lead from the relevant pin connections 4,4', 5,5' of the chip 2 to an antenna loop 6 and an induction coil 7. The antenna loop 6 and the induction coil 7 are shown schematically in Figure 1.

Referring to Figure 2, two pairs of contact pads 8,8', 9,9' are formed on each side 10,11 of the card 1. Contact pads 9,9' cannot be seen in Figure 2 as they are on the opposite side 11 of the card 1. Preferably, contact pads 8,8', 9,9' are formed on the card 1 by the application

of a conductive paint. In Figure 2, the contact pads 8,8', 9,9' are shown as two adjacent parallel rectangular blocks. The contact pads 8,8', 9,9' may be in the form of text or symbols or formed as part of a design on the card 1.

Electrical connection is made between a respective contact pad 8,8', 9,9' and a respective pin connection 4,4', 5,5' of the chip 2 by pinning through the card laminate. Thus, contact pad 8 is electrically connected to pin connection 4, contact pad 8' to pin connection 4' and contact pads 9,9' are respectively electrically connected to pin connections 5,5'.

In a preferred embodiment, a solid or hollow brass pin (not shown) having a length slightly greater than the thickness of the card 1 is punched through the card 1 so that it passes through and ohmically contacts a respective pin connection 4,4', 5,5'. An end of each pin protrudes on either side of the card 1. The protruding ends of the pin are flattened to form lands for facilitating electrical contact with the pins and, hence, the respective pin connections 4,4', 5,5'. The contact pads 8,8', 9,9' are formed on, or connected to, the flattened pin lands. For a card 1 of typical thickness, 30/1,000ths of an inch thick (0.76mm), a pin which is some 6/1,000ths of an inch (0.15mm) longer is used.

The contact pads 8,8', 9,9' provide an enlarged area of electrical contact to the chip 2. The contact pads 8,8', 9,9' comprise the contact connections to the antenna loop 6 and the induction coil 7 within the card 1 and form one path 7 through which the chip 2 can be powered up and another path 6 through which the card 1 can transmit and receive signals.

The contact pads 8,8', 9,9' on the card 1 enable co-operation with a pouch system embodying the present invention. One side of a pouch 12 embodying the invention for use with the card 1 of Figures 1 and 2 is shown in Figure 3. The other side of the pouch comprises a mirror image of the first side. When sandwiched together, the two sides form a slot 12A in which a card 1 may be inserted. A pouch 12 in the pouch system retains a card 1 in the same manner as pouches in conventional credit card wallets. However, the pouches 12 of the pouch system are also provided with electrical contacts 13,13', 14,14' within the slot 12A for connection with the contact pads 8,8', 9,9' of a smart card 1 retained in the pouch 12 to change the capacity of the smart card 1 to receive and transmit external signals.

Pouches 12 in the pouch system may have different configurations. In one configuration (not shown) of pouch 12, electrical contacts formed on the pouch 12 are electrically connected to one another to short together the two contact pads 8,8', 9,9' on the card 1 which link the respective inputs on the chip 2 for powering up the chip 2 through the induction coil 7. This has the effect that when the card 1 is inserted in the pouch 12, it is quite impossible for the card 1 to be involved in any transaction because it is not possible to provide power to the card 1. This configuration of pouch 12 enables the card 1 to be placed in a so-called "park" position in which the card 1 is stored securely in the pouch 12 without there being any danger of unauthorised remote access.

The pouch system may also comprise other pouch configurations in which the connection between electrical contacts 13,13', 14,14' on the pouch 12 (referring to Figure 3) and the electrical contacts 8,8', 9,9' on the

card 1 is used to different effect. In a second configuration, which may involve no more than re-orientation of the card 1 within a single pouch 12, or may alternatively involve placing the card 1 in a separate pouch 12' (not shown), the contact pads 8,8', 9,9' associated with the antenna loop 6 and the induction coil 7 contacts are connected to another and much larger, antenna loop 15 and induction coil 16 combination associated with the pouch system itself. This enables the card 1 to be read at a greater distance than would be possible for a conventional non-contact smart card using only the antennae within the card.

A particularly useful embodiment of this configuration (not shown) involves the placement of a card 1 in a pouch 12 which is fixed to the windscreen of a car. An antenna loop and induction coil combination formed of appropriate conducting paint or in another appropriate manner is fixed on the surface of the car windscreen and forms the power and signal pick-up for the smart card. This embodiment is especially suitable for mass transit applications such as road tolling as it thus becomes possible to take a toll from a car carrying a smart card without any need for unduly close proximity between the card and the card reader.

In a further configuration (not shown) of the pouch system, either an additional pouch, or an additional orientation within the same pouch 12, is provided in which there are no electrical connections between the pouch 12 and the card 1 retained within it. In these circumstances, the non-contact smart card will operate in the same manner as a conventional non-contact smart card having a range in the region of 10 cm - i.e. a configuration in which the range is not extended and the card 1 is not disabled.

Another useful embodiment for the non-contact smart card comprises use of the smart card as an intelligent luggage tag, the luggage tag itself comprising a pouch system embodying the present invention. Luggage tagged in this manner may be tracked whilst out of contact with the luggage owner. Rather than using the smart card itself, it is envisaged that the smart card may be cloned to provide card clones having either the same or a limited version of the information contained on the master smart card for use as such intelligent luggage tags.

It is envisaged that standard ISO cards may be adapted for use as non-contact smart cards embodying the present invention.

Methods of forming smart cards by embedding a chip within a laminated card are well known and are not discussed. Also known, is the provision of a non-contact smart card with an antenna loop and an induction coil formed on it. Non-contact smart cards in accordance with this invention can be produced using appropriate techniques and materials known for existing non-contact smart cards.

The previously described technique of making electrical and mechanical contact with the various elements within the card laminate using a through pin (not shown) may be modified to improve such connections either within or between laminates. The through pin is provided with pre-selected regions along its length which, under compression, increase in diameter or form, for example, fingers in a star pattern which radiate outwardly from the pin to make good electrical and mechanical contact with the respective element in or between laminates. In this manner a land is formed within the card. The pre-selected regions in the pin are selected to correspond to the position

within the laminate at which the element to be contacted is located. The terminations of the element to be contacted by the land may be, for example, circular holes for receiving a through pin or in the shape of a star cut-out to accept the radiating fingers from the pin.

The means of exchange of data between non-contact smart cards as employed in the invention and card readers can be as for existing non-contact smart cards. The software stored within the chip can be in accordance with existing non-contact smart cards systems and information exchanged can be according to known protocol. The card readers employed to conduct transactions with the cards and to power the cards may again be as are employed in existing non-contact smart card systems.

A contact smart card having semi-conductor circuitry but no internal induction coil and antenna can be used with the pouch system of the present invention by providing electrical connection between the semi-conductor circuitry and contact pads formed on the surface of the card. Such connection would allow the card to use the induction coil and antenna of the pouch system thereby allowing the card to operate as a non-contact smart card.

CLAIMS

1. A pouch system for smart cards, wherein said pouch system is provided with electrical contacts for connection with electrical contacts of an inserted smart card, thereby changing in use the capacity of the inserted card to receive and/or transmit external signals.

2. A pouch system as claimed in Claim 1, wherein the electrical contacts of the pouch system are configured so as to prevent the provision of power to the card by an external source.

3. A pouch system according to Claim 2, wherein the electrical contacts of the pouch system associated with the provision of power to the card are electrically shorted together.

4. A pouch system according to any one of Claims 1 to 3, wherein the pouch system has electrical contacts between which are connected an induction coil and an antenna, whereby in use said inductor coil and antenna are capable of receiving external signals for input to a semi-conductor circuit of a smart card retained by the pouch system.

5. A pouch system according to Claim 4, wherein said antenna and said induction coil are formed on a pouch of the pouch system.

6. A pouch system according to Claim 4, wherein said pouch system comprises contacts for connection to an external antenna and induction coil.

7. A pouch system according to Claim 6, wherein said pouch of said pouch system is adapted for mounting on the windscreen of a car and for connection to an induction coil and antenna formed on said car windscreen.

8. A pouch system according to any preceding claim, where there is a position or configuration for insertion of a card within the pouch system in which no electrical contact is made between the pouch system and the inserted card.

9. A smart card comprising semi-conductor circuitry including a memory section, said semi-conductor circuitry being connected to contact pads formed on the surface of the card.

10. A smart card according to Claim 9, wherein the semi-conductor circuitry is located within the card and is connected to a respective contact pad by a pin.

11. A smart card according to Claim 9 or 10, wherein the smart card further comprises an induction coil and an antenna, the induction coil and antenna being connected to the semi-conductor circuitry by conducting tracks and a conducting track is connected to a respective contact pad by a pin.

12. A smart card according to Claim 10 or 11, wherein the pin is longer than the thickness of the card such that an end of the pin protruding from the card is flattened to form a land.

13. A smart card according to any one of Claims 10 to 12, wherein a pre-selected region of the pin is adapted to expand under compression to create a land within the card

and thereby contact the semi-conductor circuitry, the induction coil or the antenna.

14. A smart card system, employing one or more pouch systems as claimed in any one of Claims 1 to 8 and one or more smart cards as claimed in any one of Claims 9 to 13 and further comprising one or more transmitters having an induction coil for provision of power to said one or more smart cards and for performance of card transactions with said one or more smart cards.

15. A pouch system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

16. A smart card substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

17. Any novel feature or combination of features disclosed herein.

The Patent Office

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Application No: GB 9600442.9 **Examiner:** John Donaldson
Claims searched: 1 to 8, 14, 15 **Date of search:** 21 January 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4M(MBA, MBF, MD, MF)

Int Cl (Ed.6): G06K 7/00, 7/01, 7/04, 7/06, 7/08, 7/10, 17/00

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 90/04239 A1	(ELECTRONIQUE SERGE DASSAULT), see page 5, line 29 to page 9, line 20	1
X	WO 89/12288 A1	(PARIENTI), see page 7, line 28 to page 8, line 4	1
X	US 5402095	(JANNIERE), see column 1, lines 5, 6, 26 to 51	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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